

# LTSI Project Update

## for LTSI-3.10 and shared kernel test trial (part 2)

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Linux Foundation Consumer Electronics working group

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## Who am I ? (Munakata)

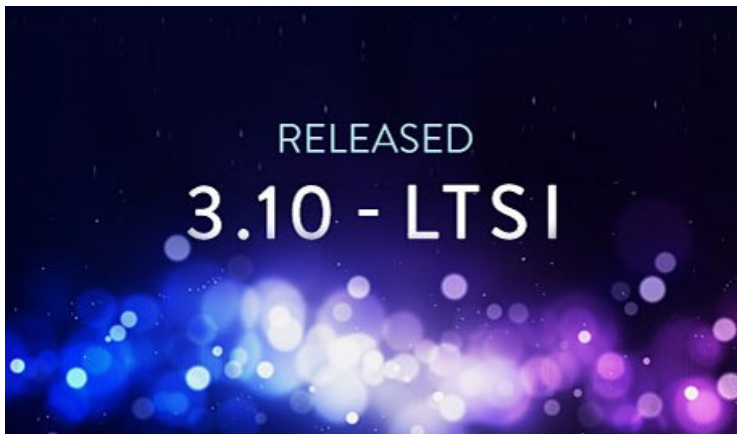
- From embedded SoC provider company Renesas
- Linux Foundation CE<sup>1</sup> working Gr. Steering committee member, LF/CEWG Architecture Gr. co-chair
- One of LF/CEWG LTSI<sup>2</sup> project initial proposer
- At my company, I had been encouraging my team developers to send a patches upstream
- Also I have supported various CE customers who develop digital-TV, Blu-ray recorder and Smart-phone

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<sup>1</sup>CE = consumer electronics

<sup>2</sup>LTSI =Long Term Support Initiative

## LTSI kernel update @ February 24, 2014



**LTSI 3.0.79 --> 3.0.101 (EOL)**  
**LTSI 3.4.46 --> 3.4.81 (update)**

## Why you should consider adopting LTS ?

# Upstream kernel @kernel.org

Protocol	Location
HTTP	<a href="https://www.kernel.org/pub/">https://www.kernel.org/pub/</a>
FTP	<a href="ftp://ftp.kernel.org/pub/">ftp://ftp.kernel.org/pub/</a>
RSYNC	<a href="rsync://rsync.kernel.org/pub/">rsync://rsync.kernel.org/pub/</a>

Latest Stable Kernel:



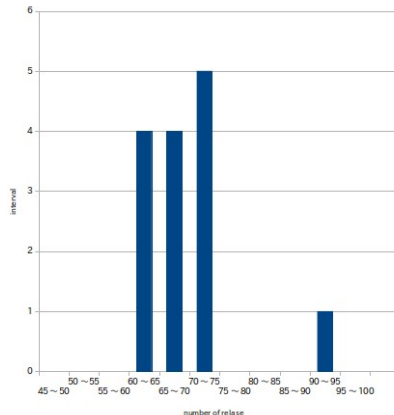
3.14.1

mainline:	3.15-rc2	2014-04-20	<a href="#">[tar.xz]</a>	<a href="#">[pgp]</a>	<a href="#">[patch]</a>	<a href="#">[view patch]</a>		<a href="#">[cgit]</a>
stable:	3.14.1	2014-04-14	<a href="#">[tar.xz]</a>	<a href="#">[pgp]</a>	<a href="#">[patch]</a>	<a href="#">[view patch]</a>		<a href="#">[cgit]</a> <a href="#">[changelog]</a>
stable:	3.13.11 [EOL]	2014-04-22	<a href="#">[tar.xz]</a>	<a href="#">[pgp]</a>	<a href="#">[patch]</a>	<a href="#">[view patch]</a>	<a href="#">[view inc]</a>	<a href="#">[cgit]</a> <a href="#">[changelog]</a>
longterm:	3.12.18	2014-04-23	<a href="#">[tar.xz]</a>	<a href="#">[pgp]</a>	<a href="#">[patch]</a>	<a href="#">[view patch]</a>	<a href="#">[view inc]</a>	<a href="#">[cgit]</a> <a href="#">[changelog]</a>
longterm:	3.10.37	2014-04-14	<a href="#">[tar.xz]</a>	<a href="#">[pgp]</a>	<a href="#">[patch]</a>	<a href="#">[view patch]</a>	<a href="#">[view inc]</a>	<a href="#">[cgit]</a> <a href="#">[changelog]</a>
longterm:	3.4.87	2014-04-14	<a href="#">[tar.xz]</a>	<a href="#">[pgp]</a>	<a href="#">[patch]</a>	<a href="#">[view patch]</a>	<a href="#">[view inc]</a>	<a href="#">[cgit]</a> <a href="#">[changelog]</a>
longterm:	3.2.57	2014-04-09	<a href="#">[tar.xz]</a>	<a href="#">[pgp]</a>	<a href="#">[patch]</a>	<a href="#">[view patch]</a>	<a href="#">[view inc]</a>	<a href="#">[cgit]</a> <a href="#">[changelog]</a>
longterm:	2.6.32.61	2013-06-10	<a href="#">[tar.xz]</a>	<a href="#">[pgp]</a>	<a href="#">[patch]</a>	<a href="#">[view patch]</a>	<a href="#">[view inc]</a>	<a href="#">[cgit]</a> <a href="#">[changelog]</a>
linux-next:	next-20140424	2014-04-24						<a href="#">[cgit]</a>

You can find 1)latest released, 2)under development  
(=mainline, next), and **several stable kernels**

## The release record of 3.0 series upstream kernel

version	release date	duration
v3.0	2011-07-21	
v3.1	2011-10-24	95 days
v3.2	2012-01-04	72 days
v3.3	2012-03-18	74 days
v3.4	2012-05-20	63 days
v3.5	2012-07-21	62 days
v3.6	2012-09-30	71 days
v3.7	2012-12-10	71 days
v3.8	2012-02-18	70 days
v3.9	2013-04-28	69 days
v3.10	2013-06-30	63 days
v3.11	2013-09-02	64 days
v3.12	2013-11-15	74 days
v3.13	2014-01-21	67 days
v3.14	2014-03-30	68 days



**Release happened regularly at around every 70 days**

## However, not all kernels are maintained for longterm

version	maintenance status
v3.0	was longterm (3.100) -> now moved to EOL
v3.1	maintained till 3.1.9, then now EOL
v3.2	longterm (3.2.55), kept maintained (by Debian)
v3.3	maintained till 3.3.8, then now EOL
v3.4	longterm (3.4.84), kept maintained
v3.5	maintained till 3.5.7, then now EOL
v3.6	maintained till 3.6.11, then now EOL
v3.7	maintained till 3.7.10, then now EOL
v3.8	maintained till 3.8.13, then now EOL
v3.9	maintained till 3.9.11, then now EOL
v3.10	longterm stable (3.10.37), kept maintained
v3.11	maintained till 3.11.10, then now EOL
v3.12	longterm stable (3.12.18), kept maintained (by ???)
v3.13	stable release (3.13.11), till 3.15 released
v3.14	latest release (3.14.1), will be maintained as stable till 3.16 is out

Note : Ubuntu 14.04-LTS adopted 3.13.5 kernel, not 3.12

# Stable release include **MUST APPLY** essential fixes

version	fixes
v3.0 -> v3.0.101	3,953
v3.1 -> v3.1.9	647
v3.2 -> v3.2.57	4,777
v3.3 -> v3.3.8	698
v3.4 -> v3.4.87	4,065
v3.5 -> v3.5.7	816
v3.6 -> v3.6.9	676
v3.7 -> v3.7.10	718
v3.8 -> v3.8.13	996
v3.9 -> v3.9.11	746
v3.10 -> v3.10.37	2,500
v3.11 -> v3.11.10	677
v3.12 -> v3.12.18	1,717
v3.13 -> v3.13.11	903
v3.14 -> v3.14.1	24

## Stable kernel rules

(/Documentation/stable\_kernel\_rules.txt)

Rules on what kind of patches are accepted,  
and which ones are not, into the "-stable" tree:

- It must be obviously correct and tested.
- It cannot be bigger than 100 lines, with context.
- It must fix only one thing.
- It must fix a real bug that bothers people (not a, "This could be a problem..." type thing).
- It must fix a problem that causes a build error (but not for things marked CONFIG\_BROKEN), an oops, a hang, data corruption, a real security issue, or some "oh, that's not good" issue. In short, something critical.

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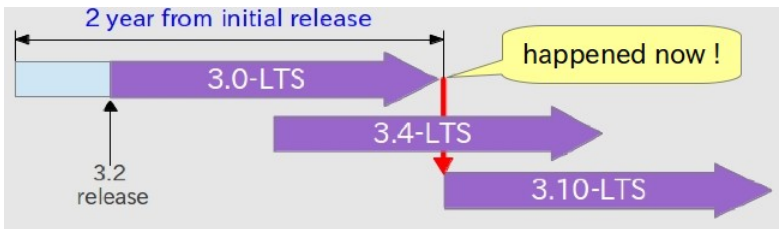
- 1) Proven (already merged) code only
- 2) Serious bug fix only
- 3) Serious security fix only



# Longterm stable (LTS) kernel release cadence

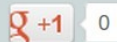
## Target kernel selection rules

- Maintainer will **choose one LTS version per year**
- **Maintain it for 2 years** from its original release
- LTSI-3.0 is moved to EOL when 3.10 became new LTS
- Then, we have 2 LTS kernels versions like 3.4 and 3.10



# LTS/LTSI maintainer, Greg says 3.0 moves to EOL

**Date** Sun, 13 Oct 2013 15:19:54 -0700  
**From** Greg KH <>  
**Subject** Linux 3.0.100



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NOTE! The 3.0.x kernel series will be moving to End-Of-Life soon,  
within a week. Please move anything that is relying on this kernel  
version to the other longterm kernel releases (3.4.x or 3.10.x) as soon  
as possible. If anyone has any questions about this, please let me  
know.

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I'm announcing the release of the 3.0.100 kernel.

All users of the 3.0 kernel series must upgrade.

<https://lkml.org/lkml/2013/10/13/160>

And, Greg also announced next longterm is **3.10**

## Longterm kernel 3.10



By Greg KH - August 4, 2013 - 4:45am

As I've [discussed in the past](#), I will be selecting one “longterm stable” kernel release every year, and maintain that kernel release for at least two years.

Despite the fact that the 3.10-stable kernel releases are not slowing down at all, and there are plenty of pending patches already lined up for the next few releases, I figured it was a good time to let everyone know now that I'm picking the 3.10 kernel release as the next longterm kernel, so they can start planning things around it if needed.

<http://www.linuxfoundation.org/news-media/blogs/browse/2013/08/longterm-kernel-310>

## Upstream kernel 3.10 development (is done)

**Whoops, we can not submit our latest device support code to 3.0 kernel now! Yes, that is true, because**

item	date
kernel 3.10 merge window open	2013.4.28
kernel 3.10 merge window close	2013.5.12
kernel 3.10 release	2013.6.30

As upstream 3.10 patch merge window is already closed, there is no chance to add your code to upstream kernel. Thus a cutting-edge silicon release after development cycle can not be supported in longterm 3.10 kernel. This might be problematic for embedded industry Linux adopter.

## LTSI 3.10 development result review

## LTSI-3.10 development history

item	date
kernel 3.10 merge window open	2013.4.28
kernel 3.10 merge window close	2013.5.12
kernel 3.10 release	2013.6.30
Announce of 2013 LTS kernel version	2013.8.4
LTSI-3.10 git tree open	2013.9.11
3.10 becomes LTS (=3.12 release)	2013.11.15
LTSI-3.10 merge window open	2013.11.15
patch collection period	75 days
LTSI-3.10-rc1 (=merge window close)	2014.1.29
validation period	26 days
LTSI-3.10 release	2014.2.24

**2014 LTSI development schedule would be similar to this.**

## message from Linus : Linux 4.0 will be stable ?!

Date Sun, 3 Nov 2013 16:10:59 -0800

Subject Linux 3.12 released .. and no merge window yet .. and 4.0 plans?

From Linus Torvalds <>

(snip)

Onto a totally different topic: we're getting to release numbers where I have to take off my socks to count that high again. I'm ok with 3.<low teens>, but I don't want us to get to the kinds of crazy numbers we had in the 2.x series, so at some point we're going to cut over from 3.x to 4.x, just to keep the numbers small and easy to remember. We're not there yet, but I would actually prefer to not go into the twenties, so I can see it happening in a year or so, and **we'll have 4.0 follow 3.19 or something like that.**

(snip)

And the reason I mention ``4.0'' is that it would be a lovely time to do that. Roughly a years heads-up that **``ok, after 3.19 (or whatever), we're doing a release with \*just\* fixes, and then that becomes 4.0''.**

<https://lkml.org/lkml/2013/11/3/160>

# Just my silly assumption

3.14	2014 3/30	
3.15	2014 6/15	75 ---> candidate for LTSI 2015 ?
3.16	2014 8/29	75 ---> candidate for LTSI 2015 ?
3.17	2014 11/11	75
3.18	2015 1/25	75
3.19	2015 4/10	75
4.0	2015 6/24	75 ---> can be used for LTSI 2016



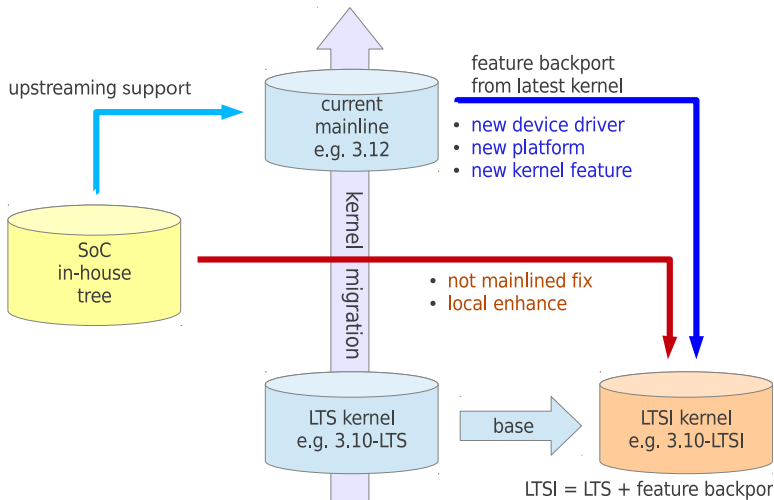
## Major contributor for LTSI-3.10

Contributor	Patch count
Darren Hart (intel)	1,197
Simon Horman (for Renesas)	1,122
Yoshitake Kobayashi (Toshiba)	123
Patrik Jakobsson (for intel)	46
Mark Brown (linaro.org)	11
Greg Kroah-Hartman (Linuxfoundation)	11
Total	2,510

# Major achievement of LTSI 3.10

- LTTng
- Power efficient workqueues
- Intel's BayTrail support
- Intel's Minnowboard support
- Renesas's R-Car H2/M2 series support backported from the latest mainline
- Xilinx Zynq board support

LTSI = community LTS(longterm) + industry extra



# Yocto and LTSI project coordination is working now



**ABOUT**

**ECOSYSTEM**

**DOWNLOADS**

**TOOLS + RESOURCES**

**DOCUMENTATION**

**Ecosystem**

- Product Showcase
- Yocto Project Participants
- Member Organizations
- Supporting Organizations
- Compliance Program
- Compliance Program Registrar

SEARCH  [Go](#)

## Long Term Support Initiative (LTSI)



LTSI is an industry-wide project created and supported by Hitachi, LG Electronics, NEC, Panasonic, Qualcomm Atheros, Renesas Electronics Corporation, Samsung Electronics, Sony and Toshiba and hosted at The Linux Foundation to maintain a common Linux base for use in a variety of consumer electronics products. The project creates and maintains a long-term industry tree, which is expected to be stable in quality for the typical lifetime of a consumer electronics product, typically 2-3 years.

This new initiative is crucial because device makers are doing significant back-porting, bug testing and driver development on their own, which carries substantial cost in terms of time-to-market, as well as development and engineering effort to maintain those custom kernels. Through collaboration in this initiative, these CE vendors will reduce the duplication of effort currently prevalent in the consumer electronics industry.

The LTSI tree is expected to be a usable base for the majority of embedded systems, as well as the base for ecosystem players (e.g., semiconductor vendors, set-vendors, software component vendors, distributors, and system/application framework providers). The LTSI project will combine the innovative features in newer kernels needed by CE vendors with a stable kernel, while helping those vendors get their code upstream to benefit the entire Linux community. The goal is to reduce the number of private trees currently in use in the CE industry and encourage more collaboration and sharing of development resources.

# Discipline of LTSI project management

- Community **LTS + industry demanded** extra patches.
- **Governed by LF/CEWG**
- **Focus on kernel** code<sup>a</sup>, not aiming complete BSP
- Therefore, can be combined with existing platform<sup>b</sup>
- **CPU architecture and platform neutral**
- **Comply with upstream** rules<sup>c</sup>
- Industry friendly acceptance (**flexible patch forms**, etc)
- Help CE (and others) industry to utilize Linux

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<sup>a</sup>device drivers are part of kernel, of course

<sup>b</sup>Android, **Yocto**, Tizen, AGL, WebOS and others

<sup>c</sup>e.g. signed-off-by process

## Shared (LTSI) kernel test project

# Why LTSI kernel validation becomes important ?

- Upstream LTS is managed to be completely safe.
- LTSI can based on community LTS kernel, and
- LTSI is the place to add various NEW things
  - Feature back port from latest mainline (relatively safe)
  - Industry demanded not-mainlined (but commonly used) open source project code
  - Privately maintained bug-fix code (may be valuable)
  - Privately developed feature code

**We want to validate LTSI kernel does not include any bug or regression against the community LTS code**

# Beyond the LTS(I) kernel use, **share the test case !**

## New value opportunity of sharing the kernel test case

- Now many industry start using LTS and LTSI kernel.
- Each company may spend a lot of time for validation.
- Some of fundamental kernel feature test might be duplicated
  - common kernel function test (detail later)
  - common kernel benchmark test (detail later)
  - common compatibility conformance test
- Now we can consider sharing the (part of) kernel test case on top of LTS(I) kernel across the industry.
- We need to assign appropriate OSS license to each test case itself so the we can share them.



# Design target of shared LTSI test environment

## feature

- Fully automated execution (nightly run)
- Easy to manage operation (add/edit test case)
- Trend monitoring capability (to catch the regression)
- User friendly interface (web access, GUI front end)

## operation

- local text execution (can install to your computer)
- test case sharing mechanism
- test result sharing mechanism (future work)
- can penetrate to the upstream kernel development use

## Current shape

### We did trial run during LTSI-3.10 development period





- Cogent Embedded / Renesas worked together.
- **We will donate environment to public** so that anyone can execute pre-build test and write own test case.
- Jenkins front-end (test automation)
- Customizations (UI/look&feel, representation)
- Open Source Test Suites (public, popular) are integrated
- Some private test suites (shell scripts) tested

**We will distribute trial version environment at the LTSI workshop (30th Wednesday 16:00 at San Carlos)**


# Implementation


- Jenkins brings - **mature, robust platform** to manage & distribute jobs (could be test/tests suites distributed across various platforms)
- Tests/test suites **wrapped into shell scripts**. Idea is to **keep environment as simple/straightforward as possible**:
  - Every step is a script: build test, deploy on target, run, collect results, parse results, cleanup
  - It should be possible to trigger scripts, run tests, collect results without complex Jenkins setup
- Targets are connected with server(s) via network (e.g. debug ethernet) and/or serial
- **Test results, status, statistics, Target configuration, etc - visualized by Jenkins (accessible via web interface)**


# Screen shot (Jenkins Web based test controller UI)





HomeENABLE AUTO REFRESH


 New Test


 People


 Test Run History

 Edit Dashboard

 Manage Jenkins

 Scripter

 Exclusion administration

 Documentation


Test Run Queue

No test runs in the queue.

Targets Status

















#	Master
1	Idle
2	Idle
koelsch	
1	Idle

## Test Automation Framework

 [add description](#)

0. History | Benchmarks | Functional | all | batch runs | +

Latest tests runs

Test	Run	Time	Platform SDK	Device
 <a href="#">Benchmark bonnie</a>	 #174	Apr 25, 2014 10:53:02 AM		minnow
<a href="#">Benchmark bonnie</a>	 #173	Apr 25, 2014 10:48:18 AM		minnow
<a href="#">Benchmark bonnie</a>	 #172	Apr 25, 2014 10:45:40 AM		minnow
<a href="#">Benchmark bonnie</a>	 #171	Apr 25, 2014 10:41:33 AM		minnow
<a href="#">Benchmark bonnie</a>	 #170	Apr 25, 2014 10:36:07 AM		minnow
 <a href="#">Benchmark bonnie</a>	 #169	Apr 25, 2014 10:34:20 AM		minnow
 <a href="#">Benchmark bonnie</a>	 #168	Apr 25, 2014 8:43:39 AM		minnow
 <a href="#">Benchmark bonnie</a>	 #167	Apr 25, 2014 2:55:01 AM		minnow
 <a href="#">Benchmark bonnie</a>	 #166	Apr 25, 2014 2:53:50 AM		minnow
 <a href="#">Benchmark bonnie</a>	 #165	Apr 25, 2014 2:52:34 AM		minnow

# Currently integrated 28 automated benchmarks

- |    |            |    |             |    |            |
|----|------------|----|-------------|----|------------|
| 1  | aim7       | 11 | gtkperf     | 21 | netpipe    |
| 2  | blobsallad | 12 | himeno      | 22 | OpenSSL    |
| 3  | bonnie     | 13 | Interbench  | 23 | reboot     |
| 4  | Dhrystone  | 14 | IOzone      | 24 | Stream     |
| 5  | cyclictest | 15 | iperf       | 25 | signaltest |
| 6  | fio        | 16 | Java        | 26 | tiobench   |
| 7  | GLMark     | 17 | linpack     | 27 | Whetstone  |
| 8  | ebizzy     | 18 | Imbench2    | 28 | x11perf    |
| 9  | ffsb       | 19 | nbench-byte |    |            |
| 10 | hackbench  | 20 | netperf     |    |            |

# Currently integrated 33 automated tests

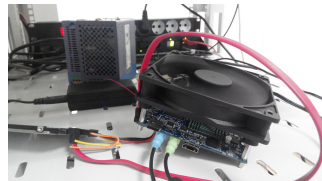
- |                 |                     |                   |
|-----------------|---------------------|-------------------|
| 1 aiostress     | 12 LTP-DDT.Devices  | 23 netperf        |
| 2 bzip2         | 13 LTP-DDT.Ipc      | 24 OpenSSL        |
| 3 expat         | 14 LTP-DDT.Math     | 25 pi_tests       |
| 4 cmt_RENESAS   | 15 LTP-DDT.Mm       | 26 posixtestsuite |
| 5 crashme       | 16 LTP-DDT.Nptl     | 27 rmaptest       |
| 6 ipv6connect   | 17 LTP-DDT.Pipes    | 28 scifab_RENESAS |
| 7 fontconfig    | 18 LTP-DDT.Syscalls | 29 crashme        |
| 8 ft2demos      | 19 LTP-DDT.Timers   | 30 sdhi_0_RENESAS |
| 9 glib          | 20 LTP.Devices      | 31 stress         |
| 10 jpeg         | 21 LTP.Filesystem   | 32 synctest       |
| 11 linux_stress | 22 LTP.Open_Posix   | 33 zlib           |

# Target configuration

- Target abstraction is just a set of environment variables
  - Target Architecture (ARM, x86, MIPS) / toolchain path
  - IP addr/login pair if target is connected/controlled via TCP/IP (SSH, FTP, telnet) or serial port parameters
  - Target power-cycle settings
  - Target Linux distro-specific settings (if any)
  - temporary folder for test suites/logs
  - command to grab system logs
- Target pre-setup required
  - Bootcode + kernel (under test) + minimal distro

## Result 1 : LTS 3.10 vs. LTSI-3.10

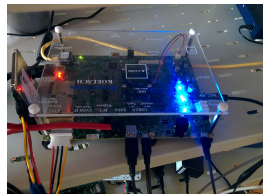
- Use **Intel Atom Minnow board**
- Minnow is a good platform to compare LTS and LTSI (at least works without additional patch lifting, headaches, etc) - example how mainline support should be done.
- **No significant deviation** in results observed, no major regressions.
- **Anomaly found**: fio-1.58 fails when running on mSD card using LTSI-3.10 (worked ok with LTS-3.10), on the other side, newer version of fio does not show similar anomaly.





## Result 2 : LTSI-3.4 vs. LTSI-3.10

- Use **Renesas R-CarM2 Koelsch board**
- Renesas is using LTSI kernels as a baseline for product-quality BSPs delivered to customers. R-Car M2 - good candidate to compare LTSI3.4 and LTSI3.10 code bases.
- **No significant deviation** in results observed, no major regressions.
- **Anomaly found**: cyclic test fails (will study further/deeper soon)



## Our struggles while we did LTSI test trial run

- We still don't have **common understand/requirements**
  - What we want to test and how we want to do this (need to collect feedback), example: some members mentioned - they don't see sense in testing on real hardware, some - want one feature tested (e.g. IPv6, using TAHI tests), some - another, etc. we need to have more formal approach to make testing useful.
- A number of problems when **comparing tests results**
  - **Hardware support often behind**, sometimes very different between various combination of linux kernels, etc. difficult to find hardware platform that would be well-maintained in LTS/LTSI trees for a while. Minnow - nice work, but now minnow-max is coming, etc.
  - **Default configurations may get changes**, behavior of some kernel features, etc. especially when comparing results from older release with new release.

# New/extended auto-test functionality 1/2

- Report generation
  - framework allows to generate readable/standalone reports) - completed
- Documentation
  - Early version - completed.
  - Improvements - in progress.
- Integration/tuning of new tests
  - Renesas board-specific tests being added now
  - A few more open source tests suites (e.g. dbench, etc.)

## New/extended auto-test functionality 2/2

Following features will be integrated soon.

- Serial port, ftp and telnet support
- ``board/target" initialization/configuration/deployment
- Automated power cycle/reboot control integration
- Build everything from source
  - target kernel
  - bootcode
  - minimal distro
- UI/Jenkins plugins improvements

## Conclusion

# Conclusion

- **Correct understanding of the longterm (LTS) cadence** is important. LF/CEWG develops LTSI version on top of community longterm kernel. You can gain huge cost reduction if you can fully utilize LTS & LTSI scheme.
- 3.0 longterm maintenance cycle has been moved to EOL and 3.10 is the next longterm support target. ALSO, **LTSI-3.10 was released in February 2014**. Now industries can share LTS-3.10 and LTSI-3.10 kernel.
- We have developed **automated kernel test framework** and tried with LTSI-3.10 release. We are hoping to **share the kernel test case** on top of commonly used LTSI kernel and upstream kernel development.

# Resources

- project web = [ltsi.linuxfoundation.org](https://ltsi.linuxfoundation.org)
- ML
  - ML subscription =  
<https://lists.linuxfoundation.org/mailman/listinfo/ltsi-dev>
  - ML archives =  
<http://lists.linuxfoundation.org/pipermail/ltsi-dev/>
  - ML patchwork =  
<https://patchwork.kernel.org/project/ltsi-dev/list/>
- git(each patch) = <http://git.linuxfoundation.org/?p=ltsi-kernel.git;a=summary>
- download (tar ball) =  
<http://ltsi.linuxfoundation.org/downloads/releases>
- twitter = @LinuxLTSI
- document archives =  
<http://ltsi.linuxfoundation.org/resources>